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Biofuel Technologies

Enzymes - a Core Issue for Biomass Biotechnological Utilization

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The awareness of the enormous environmental damages which have been caused by the use of oil and charcoal, including global warming, and the need for the development of sustainable production processes have been directing the study of biomass based processes.

In this context several industrial activities are shifting towards the use of renewable raw materials for fuels and commodities production and, more importantly, showing openness to biotechnological routes as an alternative of chemical routes. In these promising scenario biocatalysts, either whole microbial cells or enzymes play a central role.

Industrial enzymes have been already used in several industrial activities around the world, such as the food, textile, detergent and pharmaceutical - the market for industrial enzymes exceeds three billion dollars. Presently R&D activities at universities, research centers and companies face the utmost challenging issue of using enzymes for the production of fuel and chemicals from biomass.

This is a difficult task due to biomass recalcitrance towards enzymatic hydrolysis which is the only effective route; sulfuric acid-catalyzed hydrolysis, which has been widely employed in the past, produces inhibiting byproducts and causes the corrosion of equipments.

Recalcitrance, responsible for the observed low saccharification reaction yields and slow rates can be total or partially overcome via biomass pretreatment to open up the cell wall structure. Nevertheless several pretreatment methods have been developed over the past 30 years, including biological, physical, physicochemical and chemical, the discussion on pretreatment effectiveness and efficiency versus cost is still an open issue.

The pretreatment conditions direct the load and the characteristics of the cellulases – xylanases and accessory enzymes blends to be applied for biomass saccharification with direct effects on the corresponding costs. In this context research on microbial enzymes production by both wild type and GMO cells as well as on the enzymes production processes and the biocatalyst stability are of outmost relevance and have been relentlessly carried out at both the industry and the academia. Still no break trough on enzymes costs has been so far observed.

All in all biomass pretreatment effectiveness and cost as well as enzymes effectiveness and production cost are still pending issues for suitable biomass enzymatic hydrolysis reaction rates and yields. However a positive outcome in both issues is expected before long due to the tremendous research and development efforts which have been done around the world in recent years.

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